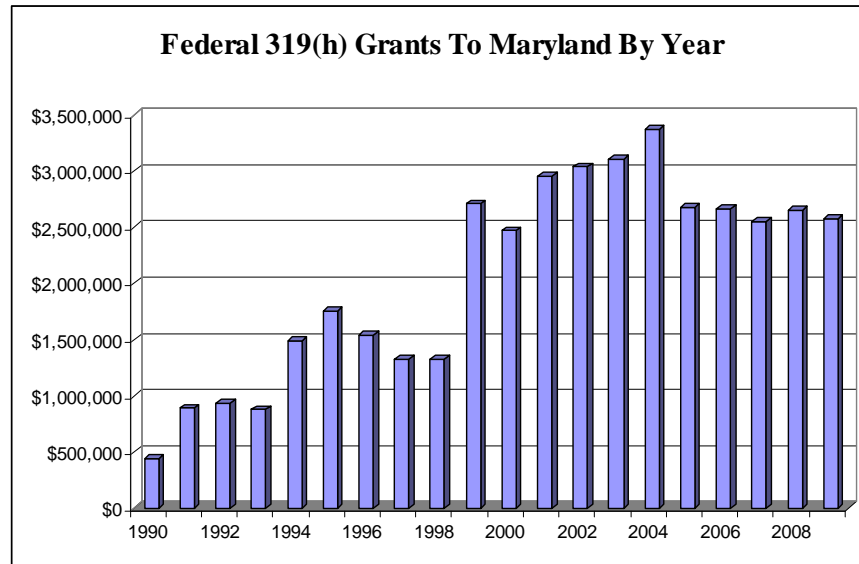


**Appendix A**  
**Financial Information - Federal 319(h) Grant Maryland Funding Summary**  
Page 1 of 1



<b>Federal Fiscal Year</b>	<b>319(h) Grant Funds (1)</b>	<b>Non-Federal Match (2)</b>	<b>Other Sources (3)</b>	<b>Total (4)</b>
1990	\$447,771	\$298,514		\$746,285
1991	\$890,039	\$593,359		\$1,483,398
1992	\$939,298	\$626,199		\$1,565,497
1993	\$877,070	\$584,713		\$1,461,783
1994	\$1,494,413	\$996,275		\$2,490,688
1995	\$1,755,964	\$1,170,643		\$2,926,607
1996	\$1,541,980	\$1,027,987		\$2,569,967
1997	\$1,327,699	\$885,133		\$2,212,832
1998	\$1,327,699	\$885,133		\$2,212,832
1999	\$2,708,298	\$1,805,532		\$4,513,830
2000	\$2,467,576	\$1,645,051		\$4,112,627
2001	\$2,958,486	\$1,972,324		\$4,930,810
2002	\$3,035,576	\$2,023,717		\$5,059,293
2003	\$3,104,500	\$2,069,667		\$5,174,167
2004	\$3,369,190	\$2,246,127		\$5,615,317
2005	\$2,675,598	\$1,783,732		\$4,459,330
2006	\$2,666,655	\$1,777,770		\$4,444,425
2007	\$2,551,736	\$1,701,157		\$4,252,893
2008	\$2,653,500	\$1,769,000		\$4,422,500
2009	\$2,575,782	\$1,717,188		\$4,292,970
<b>Total</b>	<b>\$41,368,830</b>	<b>\$27,579,220</b>		<b>\$68,948,050</b>

- 1) Grant award amount.
- 2) State and local match funds.
- 3) Other Sources are not tracked.
- 4) 319(h) Grant funds plus non-federal match.

**Appendix B**  
**List of Agency Cooperators - Maryland Nonpoint Source Program (1)**

State Lead Agency	Maryland Department of Environment Science Services 1800 Washington Blvd., Baltimore MD 21230 410-537-3902	Jim George - Director, Water Quality Protection and Restoration Program Ken Shanks - TMDL Implementation Division Eric Ruby - § 319(h) Grant Manager §319(h) Staff – Susan Douglas, Joe Woodfield Projects – James Forrest, Jen Jaber, Robin Pellicano, Sekhoane Rathhebe, Ian Spotts
State	Maryland Department of Environment Acid Mine Drainage Section 160 South Water Street, Frostburg MD 21532	Constance Lyons Loucks - Chief
	Maryland Dept. of Natural Resources, Watershed Services 580 Taylor Ave. E-2, Annapolis MD 21401 410-260-8710	Matt Fleming – Chesapeake & Coastal Programs John McCoy – Ecosystem Restoration Services Catherine Shanks – Community & Local Government Services
	Maryland Dept. of Natural Resources, Resource Assessment Service, Monitoring and Nontidal Assessment Division 580 Taylor Ave. C-2, Annapolis MD 21401 410-260-8605	Daniel Boward, Chief, Data Management and Administration Program
	Maryland Department of Agriculture 50 Harry S. Truman Parkway Annapolis MD 21401	John Rhoderick- Office of Resource Conservation
	Maryland Department Of Planning 301 W. Preston Street Suite 1101 Baltimore MD 21201-2305	Joe Tassone- Landuse Planning and Analysis
Federal	EPA Region III Nonpoint Source Program Water Protection Division Mail Code 3WP10 1650 Arch Street, Philadelphia PA 19103-2029	Fred Suffian, Team Leader David Greaves, Maryland Project Officer

**Appendix B**  
**List of Agency Cooperators - Maryland Nonpoint Source Program (1)**

Local (2)	Baltimore Co. Dept. of Env. Protection and Resource Mgmt	Candace Crosswell, Manager Capital Programs and Operations
	Calvert County Dept. of Planning and Zoning	Dr. David Brownlee. Steven Kullen, Watershed Planner
	Caroline Soil Conservation District	John Shephard, District Manager
	Carroll Soil Conservation District	via MDA
	Centerville, Town of	Bob McGrory, Town Manager. Eva Kerchner, Watershed Manager
	Dorchester Soil Conservation District	via MDA
	Frederick Co. Div. of Public Works Watershed Mgmt Sect.	Shannon Moore, Manager; Jessica Hunicke, Project Manager
	Harford County, Dept. of Public Works	Betsy Weisengoff, Environmental Engineer
	Harford Soil Conservation District	via MDA
	Maryland Coastal Bays Program	David Wilson, Executive Director
	Prince George's Co. Dept. of Environmental Resources	Dr. Mow-Soung Cheng, Assistant Associate Director
	Queen Anne's Co. Dept. of Public Works	Todd Mohn, Director. Lee Edgar, Civil Engineer
	Queen Anne's Soil Conservation District	via MDA
	University of Maryland Center for Environmental Science	Dr. Margaret Palmer, Professor and Director
	Washington Soil Conservation District	via MDA
Worcester Co. Dept. of Development Review & Permitting	Ed Tudor, Director. Keota Silaphone, Watershed/GIS Planner	

- (1) Projects active December 31, 2009.
- (2) Local includes all forms of local government.

## Appendix C 2008 BMP Implementation Progress In Maryland

From MDE's Analyzing and Tracking Nonpoint Source Data Project, FFY08 319(h) Grant  
Robin Pellicano, Febraury 2010

Type of Practice	Choptank	Lower Eastern Shore	Lower Potomac	Lower Western Shore	Middle Potomac	Outside CB	Patapsco/Back River	Patuxent	Upper Eastern Shore	Upper Potomac	Upper Western Shore	Statewide Total	Nitrogen Reduction Approx. (lb/yr)	Phos Reduction Approx. (lb/yr)
Animal Composters on Ag Lands	3	18				1			1			23	209	5
Animal Waste Management Systems-Livestock	52	32	21	4	13	2	56	54	147	700	121	1,202	1,446,967	163,841
Animal Waste Management Systems-Poultry	183	932	0	0	0	2	0	0	96	12	4	1,229	276,168	31,271
Grassed Buffers	15,455	15,127	1,016	23	71		470	649	9,940	2,620	298	45,669	447,073	52,903
Cover Crops	41,712	47,530	7,045	621	1,704	0	2,998	4,228	64,482	27,412	10,351	208,083	375,438	17,157
Dry Detention Ponds and Hydro Structures	652	1,534	2,506	1,791	15,327	839	12,853	3,096	2,437	14,564	13,248	68,846	25,138	3,111
Dry Extended Detention Ponds	282	69	322	3,054	9,947	142	8,691	4,100	396	9,105	6,590	42,696	93,540	9,648
Forest Conservation	1,647	3,803	13,737	3,347	11,792		5,333	22,869	9,011	4,806	12,317	88,662	N/A	N/A
Forest Harvesting Practices	4,016	23,022	5,358	528	385	0	831	2,135	3,241	7,370	2,577	49,464	33,859	441
Filtering Practices	47	142	117	364	1,240	22	2,710	607	131	417	1,484	7,280	21,267	1,974
Heavy Use Poultry Pads	24	103							19			146	N/A	N/A
Infiltration Practices	84	359	355	2,503	1,737	192	18,487	2,639	180	2,879	1,432	30,847	112,635	9,759
Nutrient Management Plan Implementation	160,532	223,214	49,296	13,301	38,859	55,948	68,292	52,520	264,962	264,576	105,362	1,296,862	1,476,215	260,009
Runoff Control	10	9	25	5	4	1	57	173	53	332	313	982	717	44
Riparian Forest Buffers on Ag Lands	1,262	7,408	725	51	452	0	863	776	1,880	5,647	1,351	20,415	237,034	29,106
Riparian Forest Buffers on Urban Lands	3	0	26	47	55	0	63	73	34	33	11	346	408	1,183
Retirement Of Highly Erodible Lands	393	577	1,229	101	2,215	8	1,184	822	3,867	6,481	1,022	17,898	N/A	N/A
Septic Connections to Sewers	510	796	746	354	0	0	1,010	310	4,605	2,100	579	11,009	80,396	0
Soil Conservation Water Quality Plans	95,672	140,523	29,168	5,345	15,817	29,821	21,019	42,688	157,084	167,899	59,596	764,631	870,378	153,302
Septic Denitrification	218	735	111	166	68	62	91	201	259	106	149	2,164	7,901	0
Stream Protection w/Fencing	196	30	351	102	228	495	350	734	181	3,466	721	6,852	93,589	9,158
Stream Protection w/o Fencing	20	41	226	646	250	60	6,205	6,966	270	4,300	13,448	32,432	221,504	21,674
Tree Planting on Agricultural Lands	1,324	2,035	94	91	97	0	304	345	1,851	2,988	1,091	10,221	118,669	14,572
Stream Restoration	655	3,703	1,509	5,652	39,271	0	21,110	12,625	5,057	21,102	41,830	152,514	6,944	12
Water Control Structures	6	4			3				8		6	27	203	0
Wet Ponds	1,486	5,090	4,299	3,580	20,496	889	9,066	8,532	2,885	7,661	4,745	68,727	150,570	15,530
Wetland Restoration on Ag Lands	1,736	3,005	169	5	35		105	91	2,179	201	190	7,716	89,586	11,001

1. For each type of practice in the table, data represents cumulative totals through 2008

2. Nutrient load reduction estimates for each type of practice represent the affect of each BMP acting independently. The nutrient reduction estimates fo not account for the potential aggregate affect of multiple BMPs interacting together. For example, an agricultural field may have both cover crops and grassed buffers.

**Appendix D**  
**General Approach and Schedule to Implement Applicable Management Measures**  
Page 1 Of 2

Category / Priority		Implementation Timeline (Years)		
		1998-2002	2003-2007	2009-2012
Agriculture	Statewide	Farmers using commercial fertilizers must have n & P based plans by 2002	Soil Conservation Water Quality Plans (SCWQP) on 50% of all farms by 2003	
		Farmers using animal manure or sludge must have n & P based plans by 2002	SCWQP implemented on 25% of all farms by 2003	
			Farmers using animal manure or sludge must have N&P based plans by July 1, 2004	
	Watershed Focus	Tributary Strategies	Agricultural Priority Watersheds**	
		Agricultural Priority Watersheds**		
Forestry	Statewide	Riparian Forest Buffer (RFB) goal of 43 mi/yr	RFB goal of 43 mi/yr	600 miles of RFB created by 2010
	Watershed Focus	Coastal Bays		
		Special Streams Project		
		Monocacy		
		Anacostia		
		Susquehanna		
		Town Creek		
		Rock & Carroll Creek		
Urban runoff: developing and developed areas	Statewide			
	Watershed Focus	Washington - Baltimore Metro Area, Roland Run, Redhouse Run, Severn River SWM plan		
		Anacostia Watershed		

**Appendix D**  
**General Approach and Schedule to Implement Applicable Management Measures**  
Page 2 Of 2

Category / Priority		Implementation Timeline (Years)		
		1998-2002	2003-2007	2009-2012
Marinas and Recreational Boating	Statewide	96 Certified Clean Marinas by 2002	125 Certified Clean Marinas by 2004	270 Certified Clean Marinas by 2010
				Marine Sewage Pumpout Program goal of 460 facilities by 2010
	Watershed Focus	Chesapeake Bay		
		Coastal Bays		
		Deep Creek Lake		
Channelization and Channel Modification, dams, and shoreline erosion	Statewide			
	Watershed Focus	Chesapeake Bay Shoreline		
		CWAP Priority Watersheds		
		Anacostia Northwest Branch		
		Anacostia Town Park Stream		
Wetlands	Statewide	3000 acres by 2002	10,500 acres by 2007	15,000 acres by 2010
	Watershed Focus	CWAP Priority Watersheds		
		Coastal Bays		

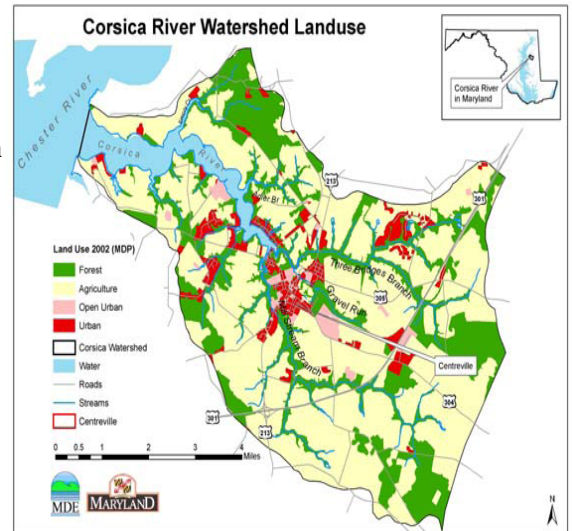
*From "Maryland Nonpoint Source Management Plan December 1999"*

## **APPENDIX**

### **Corsica River Watershed Goals and Implementation Status**

#### **Project location**

The Corsica River which is 6.5 miles in length, is located in the upper eastern shore in Queen Anne's County. The watershed area is 40 square miles and is part of the larger Chester River Watershed(see map). The land use break down for the Corsica Watershed is 66% agriculture, 26.3 % forestry, 4.5% residential urban, 3.3% nonresidential urban and .3% wetlands. The Corsica is a sub watershed of the Upper Eastern Shore Tributary basin with a Maryland 8 digit number of 02130507 and federal hydrologic unit code 02060002. It has a use II water quality designation.



#### **Background**

Implementation in the Corsica River Watershed is supported by an Implementers Group which consists of representatives from the following departments: Maryland Department of the Environment (MDE), Maryland Department of Natural Resources (DNR), Maryland Department of Planning, Maryland Department of Agriculture, Queen Anne's County Department of Public Works & Planning and Zoning, the Corsica River Conservancy, the Master Gardeners Program, University of Maryland, Queen Anne's County Soil Conservation District, the Chester River Association, and the Alliance for the Chesapeake Bay. The Corsica River Watershed Implementers Group, which meets monthly, identified specific objectives that are necessary for the Corsica River to meet its water quality goals. The 319 funds have been used mostly for capacity building such as providing salary for a watershed manager, soil conservation planner and storm water retrofit design /inspection and monitoring. Much of the implementation has been funded by other sources such as the Maryland Agricultural Cost Share programs (MACS), State Highway Transportation Enhancement Funding, DNR / MDE general funds, USDA funding for CREP and the Wetland Reserve Program (WRP). Project work on the Corsica began in 2003 and section 319 funding began in 2005. The Corsica is a five year project and has received at least \$600,000 in total 319 funding. The statewide impairments from the 303d lists are nutrients (1996), bacteria (2004), PCBs, metals, biological, sediment (1996) and other. A fecal coliform TMDL was completed on November 4, 2005, a nutrient (N,P) TMDL was completed May 9, 2000 and a PCB TMDL was submitted September 28, 2009. The annual TMDL for nitrogen is 287,670 lbs/yr and for phosphorus is 22,244 lbs/yr. The nonpoint source annual load allocation for nitrogen is 268,211 and for P is 19,380. The following list identifies the 5 year goals for the Corsica River Watershed as defined by the Implementers Group. The spreadsheet identifies the amount that has been accomplished since 2005 and that portion completed in 2009.

## **Implementation Highlights (2005-2009)**

### **1) Upgrade and Maintain Centreville Sewage Treatment Plant at Enhanced Nutrient Management**

The WWTP was upgraded with BNR at a cost of 9.6 million of which 4.5 million was funded by the state. The current capacity of the WWTP is 542,000 gallons/day and it discharges to groundwater (permit expires 8/31/12). An upgrade to ENR (Enhanced Nutrient Removal) would cost 1.1 million dollars and reduce the load to 4mg/l. Currently, under BNR, the total limit for phosphorus is 140 lbs/mo. (1.1mg/l/mo) and nitrogen 750 lbs/mo (6.0 mg/l/mo). The annual N removal is 50,770 lbs/yr and the annual phosphorus removal is 4,260 lbs/yr measured from pre-BNR. Thru inclusion of ENR.

### **2) Establish and maintain 4,000 acres of cover crops and 2000 acres of small grain enhancements annually**

The goal is to establish 4,000 acres of cover crop and 2000 acres of small grain enhancements annually. Since 2006, a total of 9,439 acres of cover crop and small grain enhancements combined have been planted. There were 1521 acres /1371 acres of cover crop and small grain respectively enrolled in 2009. This has resulted in a reduction of 75,002 lbs/953lbs of nitrogen and phosphorus respectively.

### **3) Establish 100 acres of Conservation Reserve Enhancement Program (CREP) buffers**

The CREP buffers can be divided into grass waterways, grassed buffers and forested buffers. The goal for agriculture is to establish 100 acres of buffers on agricultural land (100 ft wide/50 on either side). To date 8.1 acres of forested buffers have been established and 108.7 acres of grassed buffers have been established. In addition, 4.3 acres of grassed waterways have been installed. This has resulted in a reduction of 2,060lbs/134lbs of nitrogen and phosphorus respectively. Sediment loading has been reduced by 800 tons as a result of the installation of the grassed waterways.

### **4) / 5) Waste Storage Structures and Manure Transport**

Though specific goals have not been set for these measures, to date one waste storage structure for poultry has been built which is 3000 ft<sup>2</sup>. The result is a reduction of 210lbs/42lbs of nitrogen and phosphorus respectively. In addition 27.4 tons of manure has been relocated out of the watershed. This has resulted in a reduction of 55lbs of nitrogen.

### **6) / 7) Small Horse Pasture Management and additional BMPs on Ag Land**

The goal is to establish best management practices on 50 acres of horse pasture. Horse pasture management includes waste management plans, nutrient management plans, grazing plans and other practices that lead to the protection of soil and forages. Since 2005, 30 acres have been enrolled in the horse pasture program and in 2009 a demo horse manure composter has been purchased and will be used at several horse farms in the watershed. As a result of the work performed by the conservation planner funded by the 319 program, additional best management practices have been installed on agricultural land in the Corsica Watershed. Additional BMPs implemented on Ag land include sediment control ponds, lined waterways, fencing, grade stabilization, stream crossing, diversions, ag wetland creation. While these practices were not funded by EPA, they have resulted in additional nitrogen, phosphorus and sediment reductions. The reductions for these additional practices are 34,290lbs/4,577lbs/716lbs of nitrogen, phosphorus and sediment reductions respectively. The lead for this measure is the Queen Anne Conservation District.

### **8) Retrofit 30 septic systems with denitrification technology**

This measure calls for retrofitting 30 septic systems with denitrification technology. There have been a total of 15 installations. This resulted in a load reduction of 73 lbs of nitrogen.

### **9) Establish 200 acres of forested buffers on nonagricultural land**

So far, 12 acres of forested buffers on nonagricultural land has been put in place. This has resulted in a 28lbs/8lbs reduction for nitrogen and phosphorus.



**10) Restore 50 acres of wetlands on nonag land and 2 miles of stream channel**

There have been 32 acres of wetlands created on nonag land, 25 acres put in for 2007 and 7 acres in 2009. Stream channel restoration may be tabled due to issues related to endangered species. This has resulted in a reduction of 216lbs/24lbs of nitrogen and phosphorus respectively.

**11) Restore 10 acres of submerged aquatic vegetation and 20 acres of oyster beds**

There have been no SAVs planted since 2005. The water clarity is not sufficient for SAV planting to be a success. The measure of success is the amount of square footage of SAV planted in the spring compared to the amount of SAV surviving into the fall. The reintroduction of Oyster reef ecosystems will assist with turbidity reduction. Ten acres of oyster bars were put in place in 2009. Poaching of oysters has been a problem.

**12) Establish 300 acres of storm water retrofits**

The storm water retrofits resulted in a reduction of 100 lbs/22 lbs of nitrogen and phosphorus respectively. The Coastal Plain Outfall, captures storm water runoff from rooftops, roadways and parking lots along Banjo Lane in Centreville. The total drainage area includes approximately 10 acres. The outfall is a series of step pools bedded in sand, armored with sandstone and cobble, and planted with natural vegetation. This system treats suspended sediments, excess nutrients, and dissipates high energy; it incorporates ecologically friendly and aesthetically pleasing practices. Construction costs were funded by MDE General Funds and DNR Funds, while funds for design/inspection were from 319.

Gravel Run (Wooded Wetland) provides for the direct disconnection of impervious surface from two main drainage pipes that lead from the curb and gutter system adjacent to the northern sections of Commerce and Liberty Streets. The total drainage area of this project includes approximately 17 acres of which approximately 2.2 acres is directly attributed to impervious surface. 319 money was used for the design and State Highway Money under TEP (Transportation Enhancement Project) was used for implementation.

Sheriffs Office A bio retention swale was constructed and completed in 2009, although 319 grant funds were not used for construction or design, the Watershed Manager oversaw construction and provided inspection services.

**13) Rain Gardens**

In an attempt to manage storm water, rain gardens have been put in place. These were funded by the 310 grant and the NFWF grant which expires 5/31/10. There are approximately 1600 properties within the Corsica watershed. The goal is to have rain gardens and/or rain barrels on each property to help collect the storm water runoff from each residential property. The rain garden effort has been one of the most successful in the country with a total of 173 rain gardens put in place since 2005. On average, a rain garden will absorb 30% more water than a typical lawn. The total square footage of rain gardens installed is approximately 39,000 square feet.

**14) /15) Capacity Building/Programmatic Changes/Public Outreach**

A watershed manager position located with the Town of Centreville (Zoning Administration and Public Works) has responsibility for coordinating watershed protection projects and continuing a high level of cooperation between the Town of Centreville and Queen Anne County. This position, funded by section 319, also assists with securing programmatic changes such as recommending changes to the codes; securing third party consultative services; and supporting public outreach efforts. Thus far, a pet waste and tree ordinance were passed. The watershed sponsors Corsica Awareness Day annually to increase public awareness about the Corsica. The number of attendees for Corsica Awareness Day since 2006 are 2,250. For a comprehensive list of outreach activities, see p.42 from the report "Section 319, Nonpoint Source Pollution Control Program Corsica River Watershed Year Two Final Report".



**Coastal Plain Outfall (Before)**



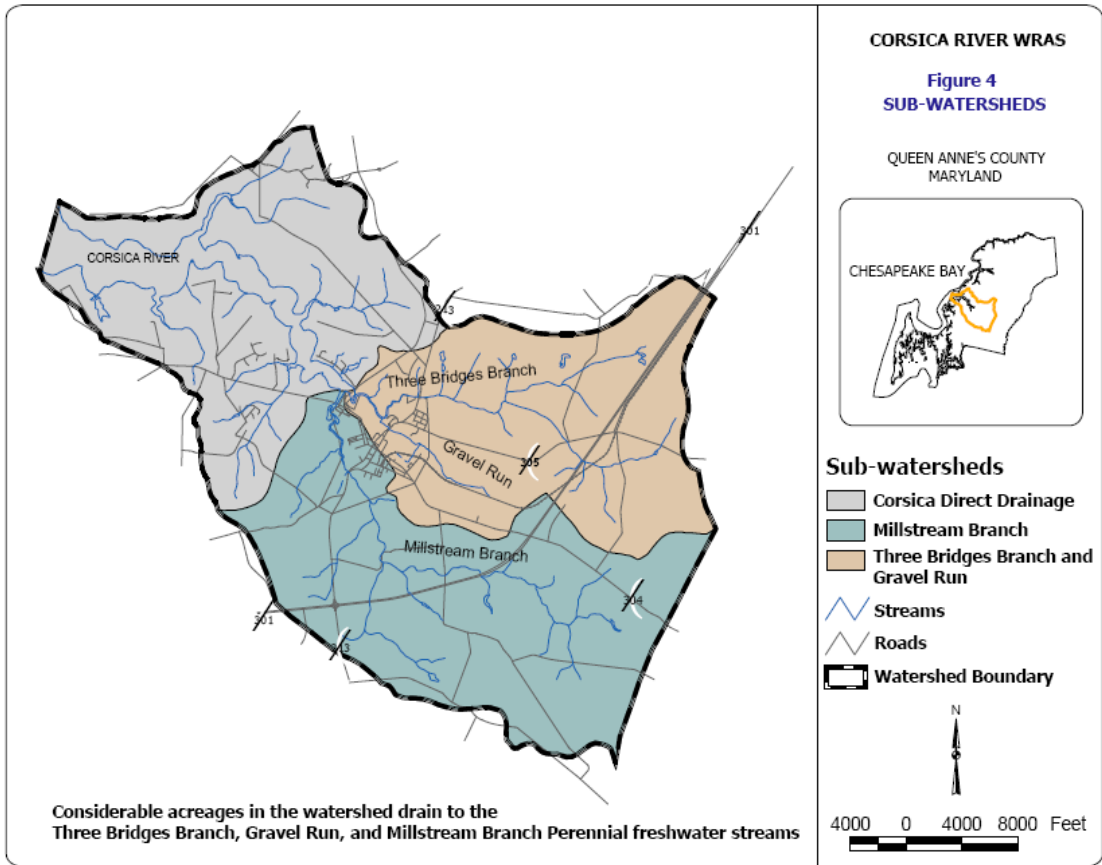
**Coastal Plain Outfall (After)**

**Drainage Areas:  
Coastal Plain  
Outfall /Wooded  
Wetland in  
Yellow/Red  
Outline**



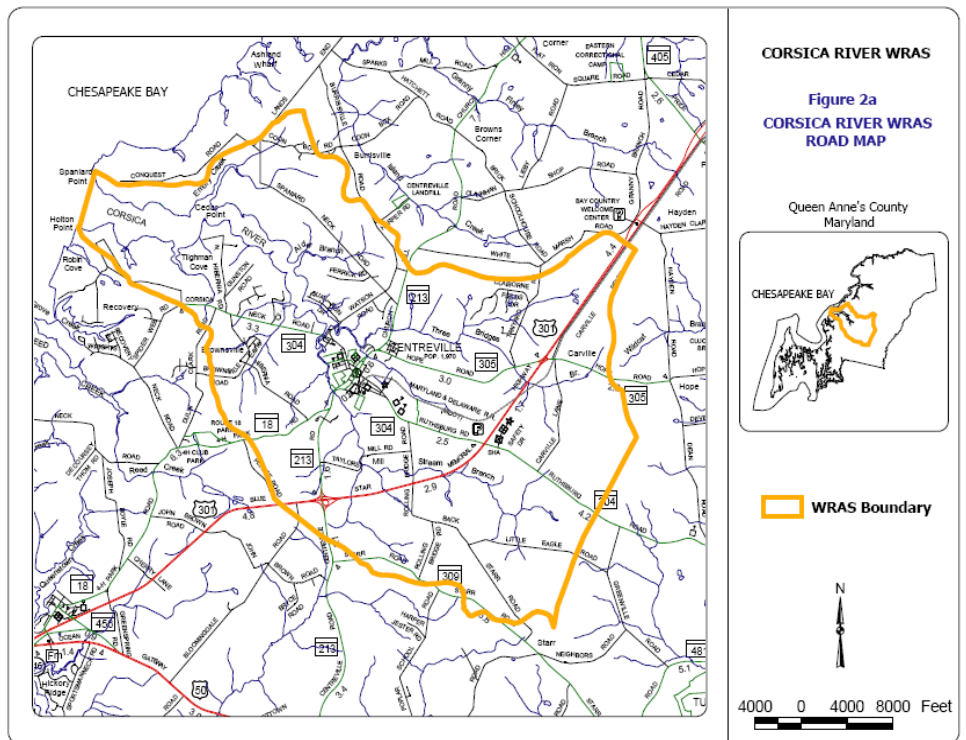
**Coastal Plain outfall in yellow/white and  
Wooded Wetland in red/white speckle**

Categories	2009	2005-2009	TL (N)	TL (P)	TL (Sed)
<b>TMDL Load (NPS)</b>			<b>268,211</b>	<b>19,380</b>	
Ag Cover Crops	1,521ac	9,439ac	75,002	953	
Ag Small Grain Enhancement	1,371ac				
Waste Remval/Containment	3000ft <sup>2</sup> 27.4 t remved	3000ft <sup>2</sup> 27.4 t remved	. 265	42	
Ag BMPS		26.47 ac 7 strcts 5238 ft	34,290	4,577	716
Septics	14	1	73		
CREP Buffers	72	121	2060	134	800
Wetlands -Urban	7 ac	32ac	216	24	
Urban Storm Wter Retrofits	27 ac		100	22	
Raingardens	39,000ft <sup>2</sup>				
<b>Total Pollutant Reduction</b>			<b>112,006</b>	<b>5,752</b>	<b>1516</b>
<b>Percent Load reduction</b>			<b>42%</b>	<b>30%</b>	



**SUBWATERSHEDS OF THE CORSICA RIVER**

**CORSICA RIVER  
WATERSHED  
BOUNDARIES**



Corsica Goals and Accomplishments	Percent Completed	2009	2008	2007	2006	Total (2006-2009)	319 Funds	Reductions			Comments
								N	P	S	
								lb/yr	lb/yr	tns/yr	
1) Upgrade Centreville WWTP to ENR							No	50,770	4,260		Has BNR, ENR would bring N load to 4 mg/l/mo ; current load 1.1mg/l P / 6.0 mg/l N. Cap. 542,000 g/d. N&P red. pre BNR thru ENR.( public wrks, Rest/Enh for the Corsica River Watershed Business Plan)
2) Establish and maintain 4,000 acres of cover crop and 2,000 of small grain enhancements annually	38% cc 69%sg (2009)	1521 ac of cover crop and 1371 ac of small grain enhan	1412 ac of cover crop and 546 ac of small grain enhan	2896 ac of cover crop and small grain enhan combined	486 ac of cover crop and 1207 ac of small grain enhan	9,439 acres combined of cover crop and small grain enhan	No (MACS)	75,002	953		Nutrient reduction calculation done using the Summary of BMP Nutrient Reduction Calculations. An average for cc and small grain N &P used for 2007 (MDA source)
3) Establish 100 acres of CREP Buffers	121%	72 ac	.9 ac		048.1ac	121 ac	No (MACS) (USDA)	2060	134	800	a-c included as part of Cons. Reserve Enhancement Prog. (CREP/CRC/UM) (MDA source)
a) Grassed Waterways		2.2 ac. (CREP)	0.1 ac (MACS)		2.0 ac (MACS)	4.3 acres	No (MACS)			800	(MDA Source)
b) Grassed Buffers		37.2 acres w/ CREP Program and 32.7 acres of switchgrass by CRC/UM			38.8 ac.	76 acres w/ CREP Program and 32.7 acres of switchgrass by CRC/UM	No (MACS) (USDA)	1,839	117		16.92lbs/ac/yr N removal and 1.08lbs/ac/yr P removal based on the Summary of BMP Nutrient Reduction Calculations (MDA source)
c) Forested Buffers			0.8 acres		7.3 acres	8.1 acres	No (MACS) (USDA)	221	17		27.28lbs/ac/yr N removal and 2.15lbs/ac/yr P removal based on the Summary of BMP Nutrient Reduction Calculations (MDA source)
4) Waste storage structures				1 Poultry Waste Structure - 3000ft <sup>2</sup>		1 Poultry Waste Structure - 3000ft <sup>2</sup>	NO (MACS)	210	42		210 lbs/yr n and 42lbs/yr p reduced 4.1.07-6.30.07(GRTS source)
5)Manure Transport		27.4 t (Horse Manure)					No	55			14.2 tons of horse manure transported out of watershed to be composted and used for veg. garden, 13.2 t of horse manure transported to Penn. For veg garden (MDA source)
6) Implement 50 ac.of Horse Past mgmt BMPs include: Nutrient Mgmt, Grazing and Waste Mgmt System Plans (Ag Demo Project)	60%	1 - Horse Manure Composter				30ac	yes				Horse manure composter purchased in 2009 as a demo. Composter in use and will serve several horse farms in the watershed. (JMcCoy)

Corsica Goals and Accomplishments	Percent Completed	2009	2008	2007	2006	Total (2006-2009)	319 Funds	Reductions			Comments
								N	P	S	
<b>7) Additional BMPs installed on Agricultural Land</b>								34,290	4,577	716	
a) Sed/Cntrl Ponds			4.0 ac			4.0 ac	No (MACS)			62	62t/yr sed reduced 10.1.08-12.31/08. (GRTS)
b) Lined Waterways				48 ft	20 ft	68 ft	No (MACS)			95	20t/yr s reduced 10.1.06-12.31.06; 75 t/yr s reduced 10.1.07-12.31.07 (GRTS)
c) Fencing			5,000 ft			5,000ft	No (MACS)	33,950	4,550		6.79lbs/ft/yr N removal and 0.91lbs/ft/yr P removal based on the Summary of BMP Nutrient Reduction Calculations (MDA source)
d) Grade stabilization			5 Structures			5 Structures	No (MACS)			292	292 t/yr s for 4.1.08-6.30.08; (MDA source)
e) Stream Crossings			1 Structure		1 Structure	2 Structure	No (MACS)			104	104 t/yr s reduced 10.1.06-12.31.06 (GRTS)
f) Diversions			110 ft	60 ft		170 ft	No (MACS)			163	(MDE staff)(GRTS)
g) Ag wetland creation			12.47 ac			12.47 ac.	No (WRP)	340	26.8		27.28lbs/ft/yr N removal and 2.15lbs/ft/yr P removal based on the Summary of BMP Nutrient Reduction Calculations (Theodora Kramer) (MDA source)
8) Retrofit 30 septic systems	63%	14	1			15	No	73			(MDE staff)
9) Establish 200 ac of forested buffers on nonag land	6%	0				12 ac		28	8		source JMcCoy, MDE staff
10) Restore 50ac of wetlands and 2 miles of stream channel	64%	7ac		25ac		32ac		216	24		7 ac on Conquest Beach & Bloomfield and 25 ac on Kramer & Higgs properties (source JMcCoy, MDE staff)
11) Restore 10 ac of SAV/20 ac of oyster beds	0%/50%					0- SAV, 10-oysters	No				source JMcCoy
12) Establish 300 acres of storm water retrofits	9%	27				27 ac	Yes	100	22		10 ac /on Outfall 15 ac on Gravel 34.4/ 4.25 and 27.3/1.68 N/P reductions for Gravel Run and Coastal Plain respectively. Based on 17 ac of drainage area. (MDE staff)
13) Rain Gardens (200)	87%	49				173					Goal is to have a raingarden for all 1600 residents. 5 raingardens currently funded by NFWF grant expires 5/31/10.

Corsica Goals and Accomplishments	Percent Completed	2009	2008	2007	2006	Total (2006-2009)	319 Funds	Reductions			Comments
								N	P	S	
14) Capacity Building/Programmatic Changes			Tree Ord.	Pet Waste Ord		Tree Ordinance, Pet Waste Ordinance	Yes				Watershed manager coordinates projects. Ran out of money for a Flood Plain, Zoning ,Subdivision Ord..
15) Public Outreach- Corsica Awareness Day- Attendance		900	650	400	300	2250					



## Section 319

# NONPOINT SOURCE PROGRAM SUCCESS STORY

# Maryland

## Restoring Stream Reduces Nitrogen in an Urbanized Watershed

### Waterbody Improved

Uncontrolled stormwater runoff caused stream erosion and degraded riparian habitat in Maryland's Minebank Run and Lower Gunpowder Falls watersheds. Maryland Department of the Environment (MDE) added Lower Gunpowder Falls (including Minebank Run) to the state's Clean Water Act (CWA) section 303(d) list of impaired waters for nutrients (phosphorus) in 1996. On the basis of benthic and fish assessments, MDE also classified the waterbody as impaired for biological integrity in 2006. Project partners implemented numerous stream restoration activities that led to visible and measurable water quality improvements. Until additional improvements are documented, however, the segment will remain on the impaired waters list.

### Problem

Minebank Run and Lower Gunpowder Falls are in the scenic Cromwell Valley in eastern Maryland's Baltimore County. Minebank Run is an urban headwater stream that joins the Gunpowder River just south of Loch Raven Reservoir, at which point the watershed is called Lower Gunpowder Falls. Minebank Run drains 2,135 acres and makes up approximately 7 percent of Lower Gunpowder Falls' 29,470-acre watershed. The watershed was once primarily used for agriculture but is now densely developed in specific areas.

Minebank Run receives a high volume of runoff from impervious surfaces in suburban residential areas, office parks, highways and other areas surrounding Towson, Maryland. MDE first added the Lower Gunpowder Falls watershed, including Minebank Run, to the state's CWA section 303(d) list for phosphorus impairments in 1996. In 2006 MDE also listed it as impaired because it did not meet its designated use of aquatic life and wildlife support.

Before the restoration, Minebank Run exhibited severe bank incision, a disconnected floodplain, degraded fish and invertebrate habitat, loss of the riparian zone, and high sediment and nutrient loads from stormwater runoff. Stormwater conveyance channels, built to remove stormwater from roads quickly and not to protect hydrologic morphology, caused flashy, high-volume flows that eroded streambanks (Figure 1), exposed sewage trunk lines and damaged park roads and access bridges. Maryland Biological Stream Survey data confirmed that the number and diversity of macroinvertebrates and fish were lower than they should be, indicating that Minebank Run was in an unhealthy, degraded condition.



Figure 1. High-volume stormwater flows damaged this stretch of Minebank Run.

### Project Highlights

Baltimore County Department of Environmental Protection and Resource Management (DEPRM) conducted two phases of restoration activities—the first in 1999 and the second in 2005—on Minebank Run, a subwatershed within the Lower Gunpowder Falls watershed. In 1999 DEPRM worked to stabilize highly erodible banks, construct point bars, and add riffles and meander features with step-pool habitats along 8,000 linear feet in a headwaters portion of Minebank Run (Figure 2).

The project reduced the stream gradient to allow the stream to overflow its banks and reconnect to the floodplain. Reconnecting the floodplain allows phosphorus and sediment to be deposited on the floodplain rather than be carried downstream. It also provides a greater residence time for nitrogen to be removed by native vegetation uptake and



Figure 2. DEPRM added riffles, meanders and step-pool habitats during phase one of the project.



Figure 3. Minebank Run at Loch Raven High School, before restoration.

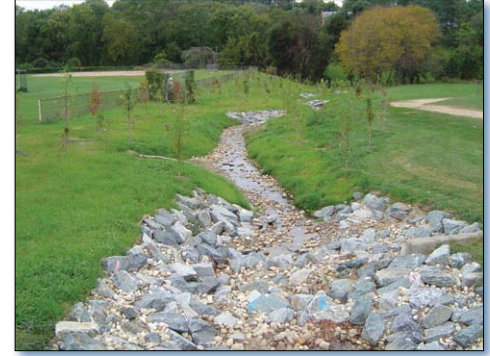


Figure 4. Minebank Run at Loch Raven High School, after phase two of the restoration project.

denitrification. The restoration involved planting 3,000 trees and 6,000 shrubs, which created a buffer and encouraged the uptake of available nitrogen.

DEPRM began the second phase of restoration in 2005 on a downstream reach of approximately 9,500 linear feet of Minebank Run. This phase had similar objectives as the first but was more extensive, involving removing a 500-foot concrete channel that conveys stormwater from Cromwell Road to Minebank Run (Figures 3 and 4). The restoration, on the grounds of Loch Raven High School, included adding step-pools, increasing the stream's sinuosity and planting riparian vegetation—all of which help dissipate flow energy, reduce erosion, moderate water temperatures and create stream channel and riparian habitat. Once the projects were complete, monitoring and geomorphologic evaluations were conducted over several years by a variety of project partners.

DEPRM armored stream banks at key locations to protect existing infrastructure such as sewer lines, bridges and roads. That has the beneficial effect of making the stream more hospitable to benthic macroinvertebrates and fish by decreasing flow speed, preventing scour and minimizing damage to aquatic habitat.

## Results

The second phase of the Minebank Run project included reconnecting the stream to the floodplain and evaluating the results. A number of study partners collaborated to assess the projects between late 2003 and mid-2004. Results indicate that the project measurably reduced the bioreactive nitrogen

(nitrate and nitrite) concentration in the surface water and groundwater. Nitrogen concentrations declined by 25 to 50 percent [1.5 milligrams per liter (mg/L) to 0.8 mg/L], while denitrification rates increased nearly twofold in test wells.

The project efforts removed an estimated 50,000 pounds (25 tons) of sediment typically discharged from the stream annually. Associated phosphorus reductions could range from 100 to 200 pounds annually. The projects have had many beneficial effects by reducing flow and increasing dissolved oxygen levels. The stream's physical and hydrological conditions appear to have improved substantially; however, measurable water quality and biological improvements will likely not occur a several years. In the meantime, DEPRM will continue to monitor biological conditions in both waterbodies.

## Partners and Funding

DEPRM led the restoration and mitigation efforts. Partners in the nationally recognized floodplain denitrification study include the U.S. Geological Survey, Institute of Ecosystem Studies, DEPRM, and the University of Maryland's Center for Environmental Science.

Some state and federal funding partners participated at different stages to assist with and document the work. In 2003 Maryland's CWA section 319 program provided \$150,000 to support DEPRM's efforts; that was complemented by another \$100,000 in local match funding. Overall, Baltimore County estimates that the costs for Phases I and II were \$2.2 million and \$4.4 million, respectively.



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